



ALMA

Transition from Construction to Operations

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Head of Technical Services

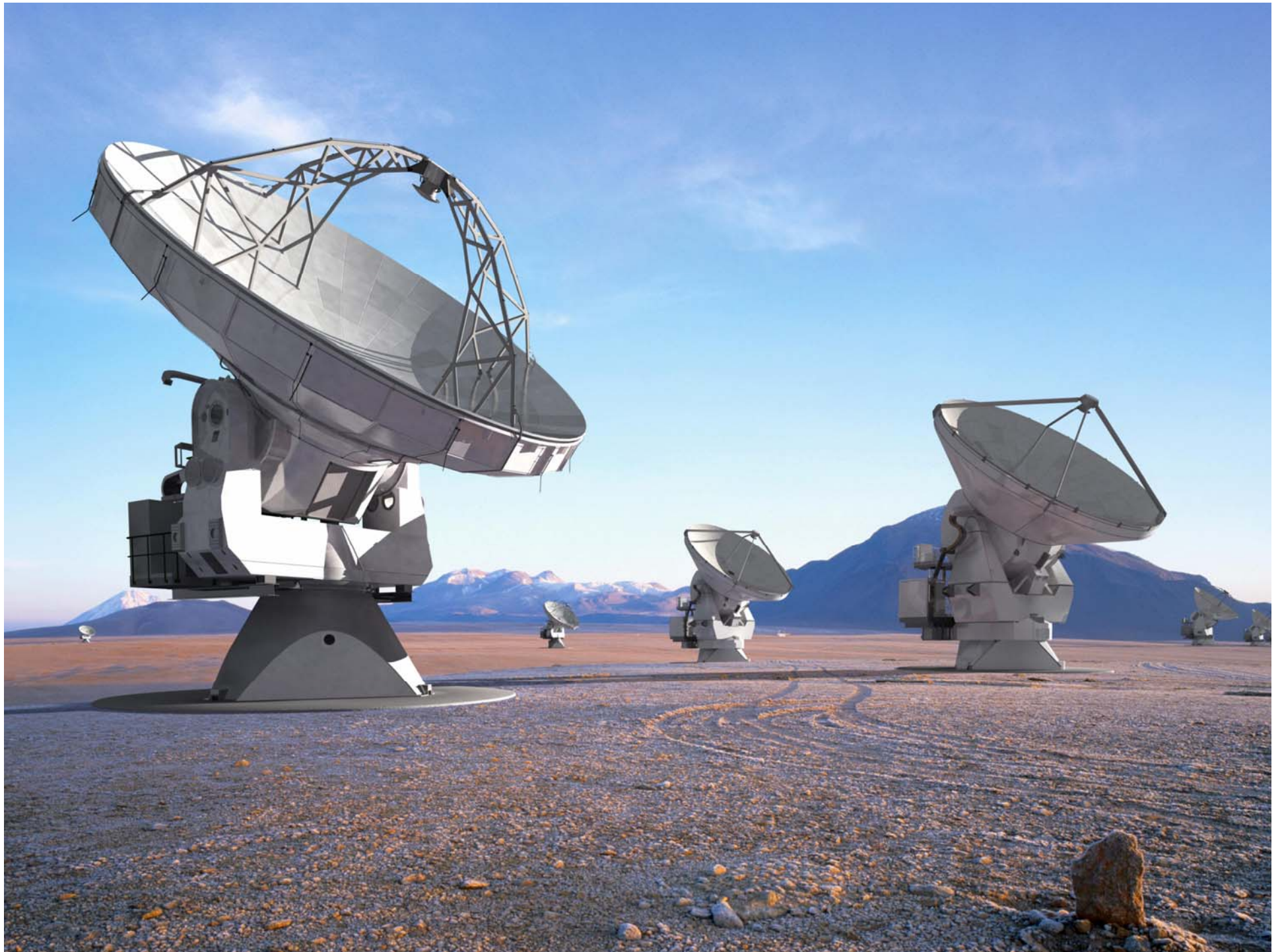
Joint ALMA Observatory

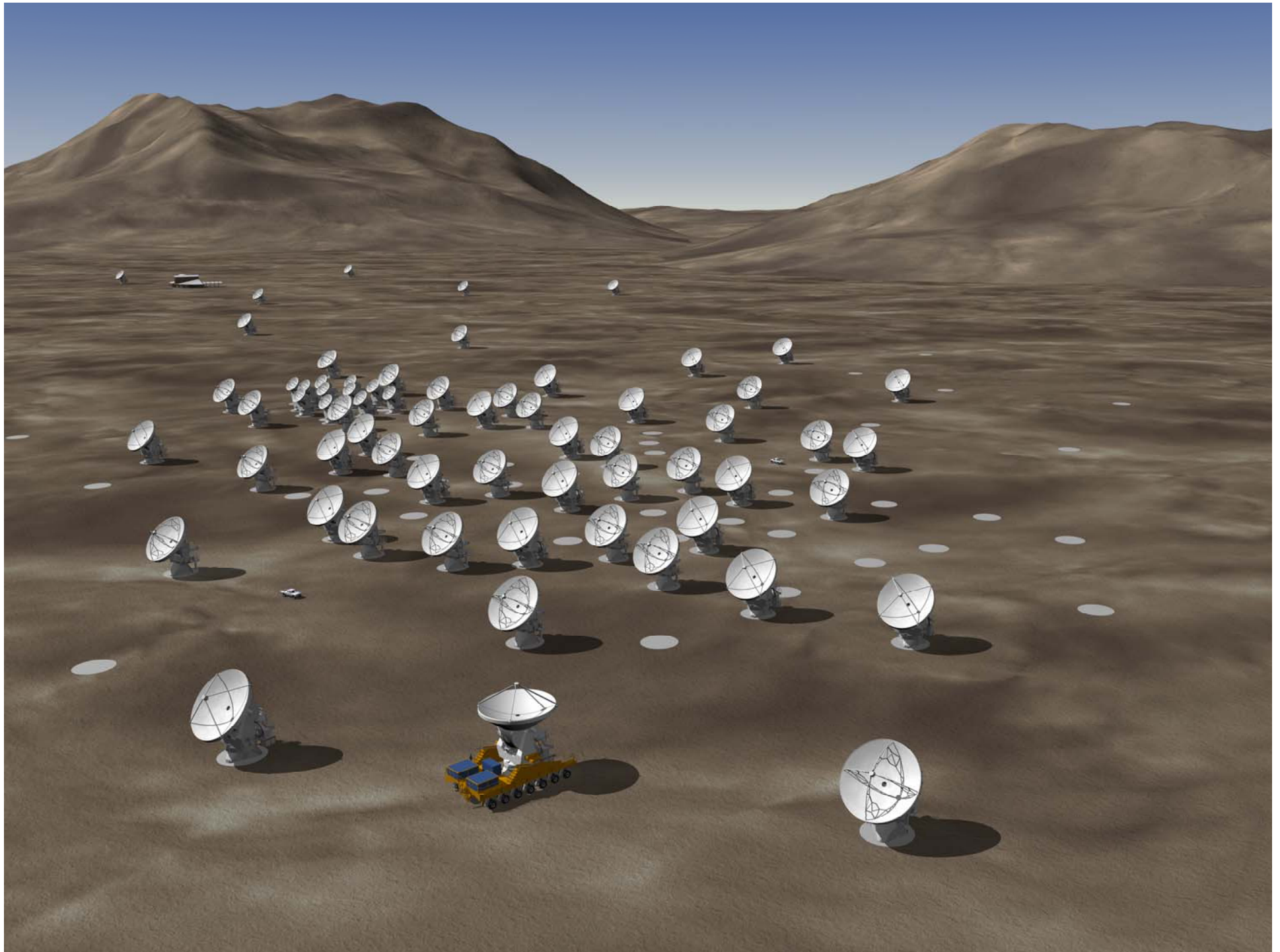
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What is ALMA ?

- Most advanced radio telescope in the world
- mm/submm equivalent of the Hubble Space Telescope
- At least 66 antennas:
 - 54 antennas of 12m diameter
 - 12 antennas of 7m diameter
- Observing frequencies from 30 GHz to 950 GHz (10 mm to 0.3 mm) in ten bands
- Unprecedented sensitivity and resolution





First Move of ALMA Antenna (July 8, 2008)







ALMA Challenges

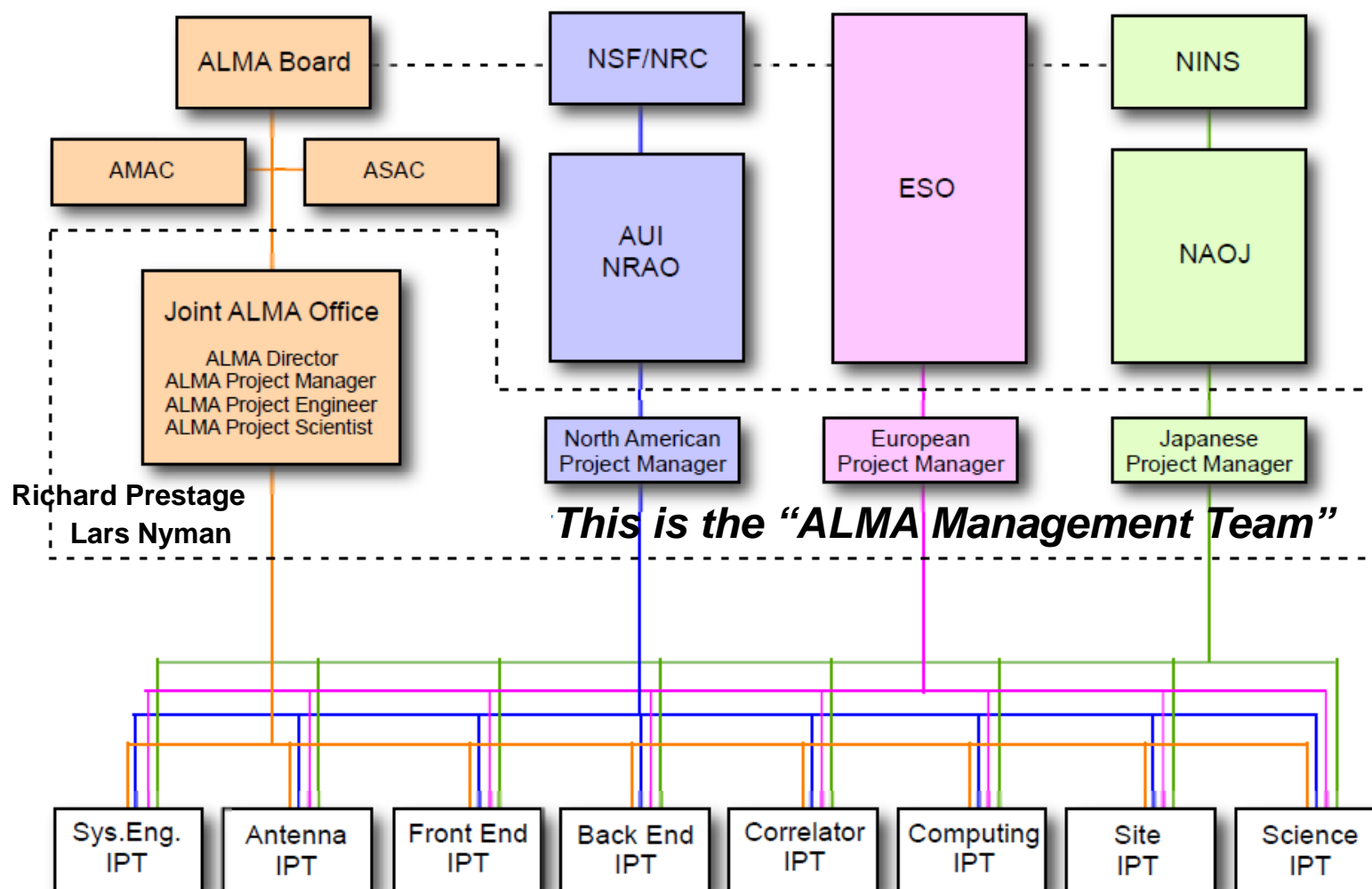
- Technology
 - First time to build such a large interferometer
 - Beyond state-of-the-art technology (detectors)
 - State-of-the-art technology in large quantities
- Organization
 - First time to have such a large (world-wide) collaboration in astronomy
 - Three administrative systems, cultures, mentalities,
 - Complex – but necessary – management structure
- Logistics
 - First time to have such distributed manufacture
 - First large observatory to operate at 5000m



ALMA Organization

- ESO, AUI/NRAO, and NAOJ (the three “Executives”) decided to jointly build and operate ALMA
- To this end, the *Joint ALMA Observatory (JAO)* has been created in Chile
- The ALMA Board has overall responsibility for the JAO
- Technical work is mostly carried out in IPTs (IPT – Integrated Product Team)
- Deliverables are agreed and costs are shared between partners

ALMA Construction Management Structure

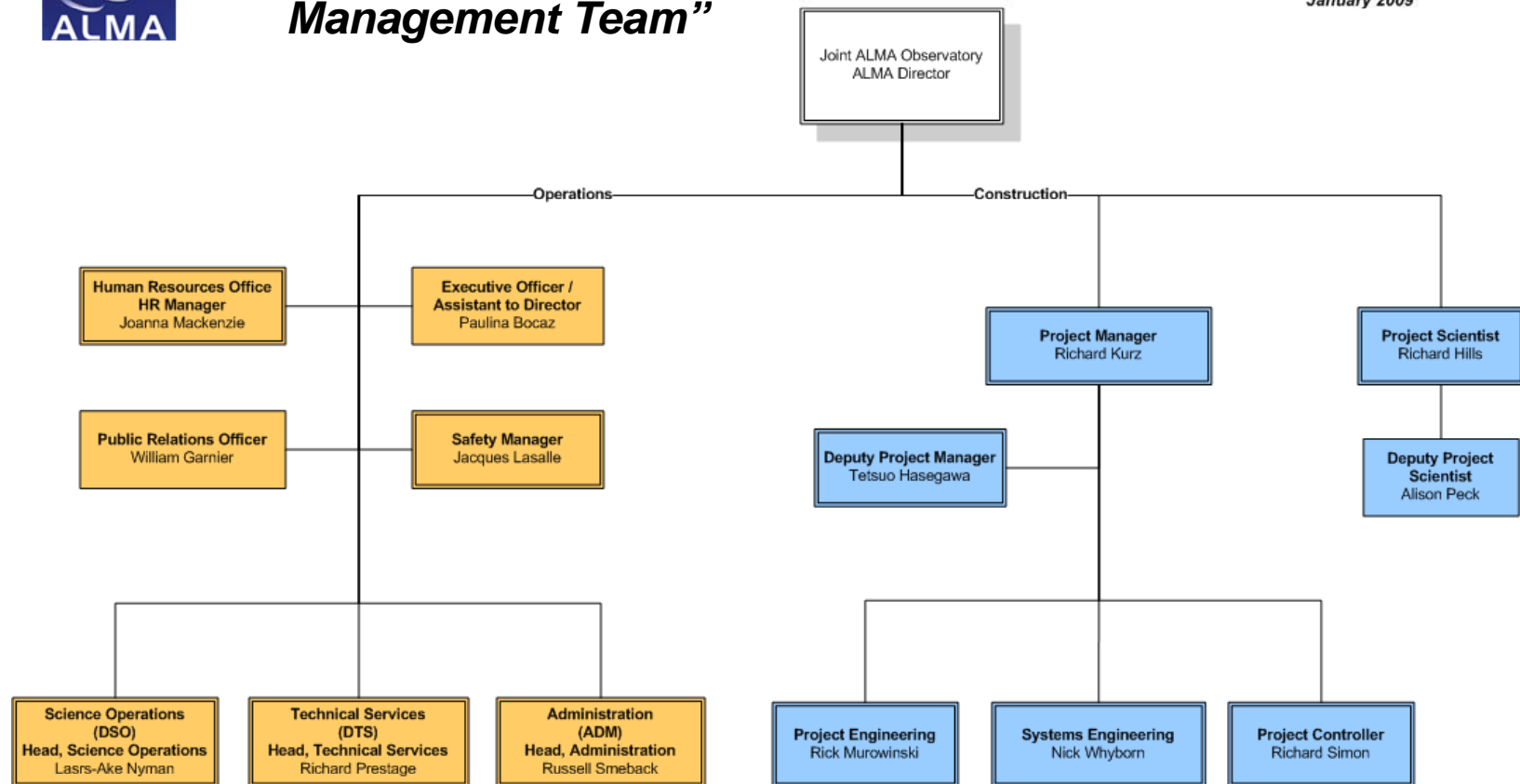


JAO Top Level



This is the “JAO Management Team”

JOINT ALMA OBSERVATORY
OPERATIONS & CONSTRUCTION
GENERAL CHART
Heads of Department & Managers
January 2009





Construction Status

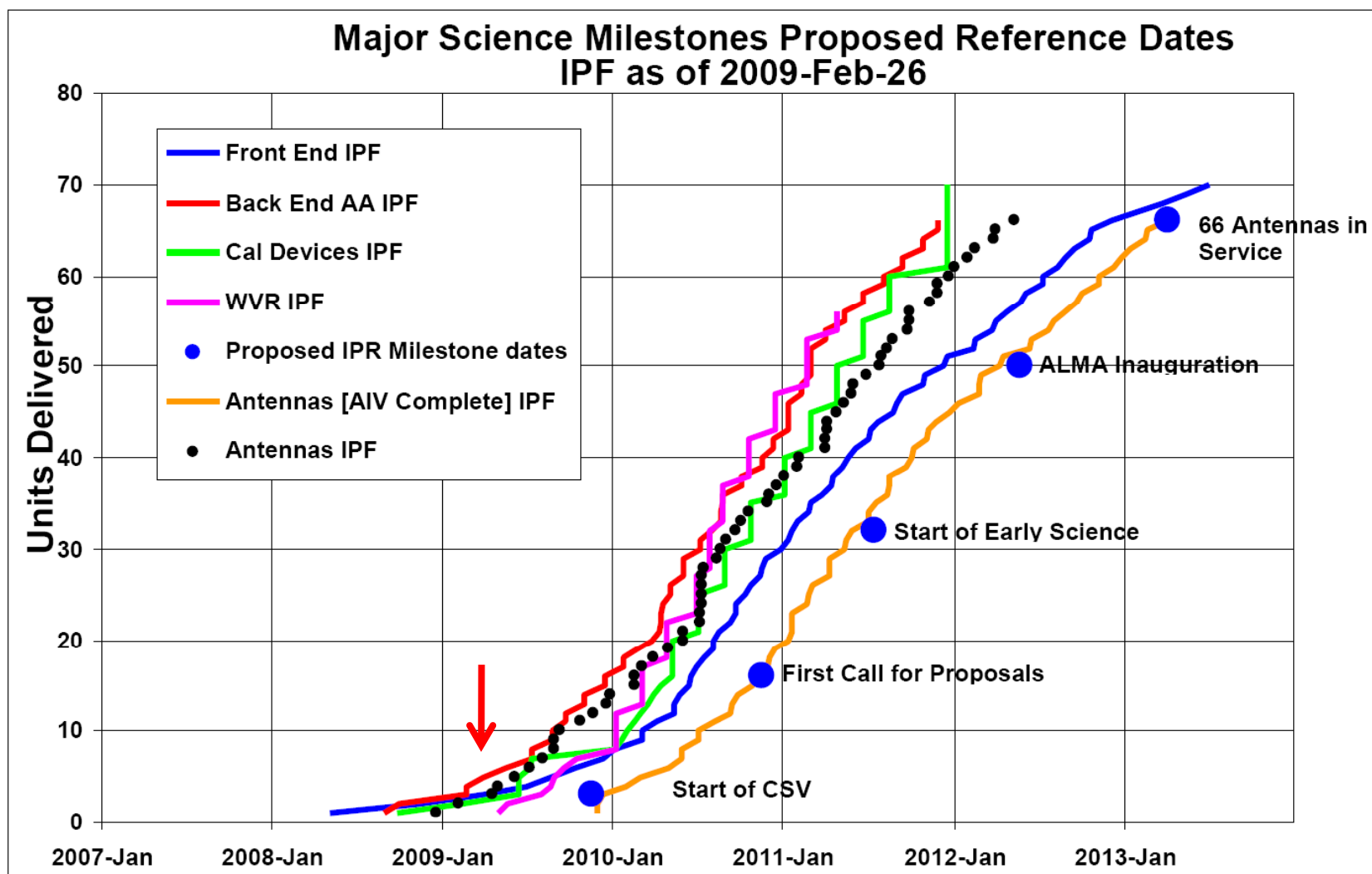
- **General**

- Design is complete and production of the components of the system is well underway with a few exceptions
- Substantial amounts of equipment have been delivered to the OSF
- We have started system assembly, integration, and verification (AIV)
- Proceeding towards the start of commissioning and science verification (CSV) with “conditionally” accepted components (less than full acceptance testing and verification)

- **Management**

- The new management team is fully in place effective Nov 2008
- Focused on in-depth review of the project schedule and establishing control of the schedule

Science Milestones





Transition Challenges

- **Communication, communication, communication**
 - What the heck is going on?
 - What are the priorities?
 - Who is in charge of what?
- **Implicit, unwritten assumptions**
 - Big differences between the three executives
- **Transferring knowledge and experience**
 - from NA, EU, EA design engineers to Chilean maintenance techs
- **Exacerbated by recruitment of all-new Operations Staff**



Transitions (II)

- ALMA has a four-stage process:
 - Construction → AIV → CSV → Operations
 - How to avoid information loss at each stage?
 - Form merged teams; staff effort accounting if necessary
- Construction → AIV seems hardest (maybe because that is the one we are in).
 - Construction staff do come to Chile; but under strong time pressure, little time for in-depth training



Solutions / Proposals

- Hire Senior Operations Staff, and one level down, very early on:
 - ALMA Hired Head of Science Operations early, but Head of Technical Services came late
 - ALMA Hired Chief Operator already, but again, senior DTS staff (AG, EG Manager, etc) came late
 - Hire Ops Management Staff before engineering staff, not vice versa
- Hire AIV, CSV and Operations staff from the beginning into a Matrix structure
 - How to keep construction staff to end of project? Offer completion bonuses? Tied to milestones, not fixed calendar dates
 - Separation of Construction and Operations Funding should not drive staffing decisions (e.g. use time accounting to keep track)
- ***Secondment of staff from parent organizations***
- ***Make sure your Operations organization is set up well in advance of when Operations will commence!***



Facilities / Infrastructure

- Build the Construction site infrastructure with Operations in mind to avoid interference in operations
 - Location of permanent buildings (i.e. where to locate the Residencia)
 - Living and sleeping conditions near construction activities (i.e. night dorms)
 - Operations traffic through construction sites, potential safety concerns (particularly foot traffic areas and accidents on unfinished roads)
- Beware of undersized facilities/utilities when Construction and Operations are performed simultaneously (i.e. sewage treatment plant, camp/ cafeteria/ recreation facilities)
 - Unreliable conditions Operating with temporary utilities (i.e. power)
- Carefully consider the design and location of temporary facilities because they tend to become permanent
 - Vertex hangar
 - AIV Lab



www.alma.info

The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership among Europe, Japan and North America, in cooperation with the Republic of Chile. ALMA is funded in Europe by the European Organization for Astronomical Research in the Southern Hemisphere, in Japan by the National Institutes of Natural Sciences (NINS) in cooperation with the Academia Sinica in Taiwan and in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC). ALMA construction and operations are led on behalf of Europe by ESO, on behalf of Japan by the National Astronomical Observatory of Japan (NAOJ) and on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI).